Quantum Simulations, Inc.

RELATED IES SBIR AWARDS:
2000: Phase I: $50,000; 2001: Phase II, $300,000
2002: Phase I, $75,000; 2003: Phase II, $500,000

KEY INFORMATION:
Address: 5275 Sardis Road, Murrysville, PA
Website: http://www.QuantumTutors.com
Demo: http://www.youtube.com/watch?v=5-VpZd_1yWM
Contact: Al Renshaw;
al.renshaw@quantumsimulations.com

PROJECT TITLES: Quantum Tutors®; Quantum Assessment Advisors®

PRODUCT: Quantum's web-based artificial intelligence (AI) learning tutors and assessment tools support K-16 student and adult learners in chemistry and mathematics. The tutors facilitate and scaffold learning through an interactive process. Through this process students select their own problems, ask questions, and receive automated step-by-step tutoring feedback. The on-demand tutors can be used in classrooms in direct support of a curriculum or as an independent tool for self-study, homework, or test preparation.

DEVELOPMENT: The product was developed iteratively to ensure that the needs of users and the education market were addressed. For the tutoring component, a code library and rule-based problem solver were implemented to enable the AI engine to accurately analyze and guide student work. Question-and-answer rules and content for student queries were developed. For the assessment component, detailed algorithms were extended to the AI framework. An algorithm was designed for automatically grading and recording student work, and reporting capabilities were developed for teachers.

RESEARCH: Research during these projects demonstrated feasibility as the tutors worked on all operating systems, as teachers indicated successful integration within standard practice, and as students indicated high levels of engagement. Results from a pilot study found a correlation between using the tutor and improved grades for high school students using the tutor (N=31) compared to a control group (N=20). Further research on the impact of the Quantum chemistry tutors is underway through an efficacy trial funded by the Institute's Math and Science Research Grants Program. Results will likely be available in 2012.

PATH TO COMMERCIALIZATION: The tutors have been commercialized through direct sales and distribution partnerships with textbook publishers Holt, Rinehart and Winston, and McGraw-Hill. Partners incorporate the tutor in distinctive ways such as integrating it with homework systems and online learning materials. As of 2011, Quantum has received $1.5 million in revenue, has delivered more than half a million online tutoring sessions, and presently has more than 10,000 users in high schools and colleges.

SELECTED PEER REVIEWED PUBLICATIONS FROM THIS R&D:

•Johnson, B., & Holder, D. (2002). A Cognitive Modeling Tutor Supporting Student Inquiry for Balancing Chemical Equations. *The Chemical Educator*, 7.

•Walsh, M., Moss, C., Johnson, B., Holder D. & Madura, J. (2002). Quantitative Impact of a Cognitive Modeling Intelligent Tutoring System on Student Performance in Balancing Chemical Equations. *The Chemical Educator*, 7.

•Kuhel, J. et al. (2010). Quantitative Impact of an Artificial Intelligence Tutoring System on Student Performance in Assigning Oxidation Numbers in Chemical Formulas. *The Chemical Educator, 15*.

AWARDS:

•2009 & 2010: *The Platinum Award* for best practices in distance learning programming, by the U.S. Distance Learning Association.

•2006: *The Tibbetts Award* for innovative research and development, by the US Small Business Administration.